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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/672,416

09/26/2003

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07/07/2006

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EXAMINER

VAN, LUAN V

ART UNIT

PAPER NUMBER

1753

DATE MAILED: 07/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/672,416

Applicant(s)

TENCH ET AL.

Examiner

Luan V. Van

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 23 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 10-15, 17-20 and 24-33 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 10-15, 17-20, 24-33 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 23, 2006 has been entered.

### ***Response to Amendment***

Applicant's amendment of May 23, 2006 does not render the application allowable.

### ***Status of Objections and Rejections***

All rejections from the previous office action are maintained.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 10-13, 17-19, 24, 26-28 and 30-32 are rejected under 35 U.S.C. 102(b) as being anticipated by Merricks et al.

Regarding claims 10, 12, 13 and 24 Merricks et al. teach a copper electroplating bath, comprising: water as a solvent (paragraph 21); copper ions (paragraph 21); pyrophosphate anions (paragraph 24); Na and K cations added to the electroplating bath as a salt of anions, such that pyrophosphate anions are present in the electroplating bath in stoichiometric excess relative to copper ions (paragraph 24); 2,5-dimercapto-1,3,4-thiadiazole organic additive (paragraph 28) at a concentration in the range from 0.1 ppm to 1000 ppm (or 0.75  $\mu$ M to 7500  $\mu$ M), which is within the range of the instant claim; and a surfactant (paragraph 29). Electrodepositing copper metal in Damascene trenches and vias to form circuitry on semiconductor chips is an intended use of the instant invention and, thus, is not given patentability weight.

Regarding claim 11, Merricks et al. teach a copper electroplating bath wherein cations other than copper ions are not electroactive at the potential used for copper electrodeposition, such that relatively pure copper metal is deposited (paragraph 10).

Regarding claim 17, Merricks et al. teach a copper electroplating bath wherein the temperature is maintained between 100F to 135F (or 38C to 57C), which is within the range of the instant claim (paragraph 31).

Regarding claim 18, Merricks et al. teach a copper electroplating bath wherein the pH is maintained in the 8.0 to 8.8 range (paragraph 24).

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Regarding claim 19, Merricks et al. teach a copper electroplating bath comprising ammonium ion (paragraph 25).

Regarding claims 26-27, Merricks et al. teach a process for electrodepositing copper circuitry in trenches and vias on semiconductor chips, comprising the steps of: providing a semiconductor chip with trenches and vias to be filled with copper (paragraph 18 and 32); placing said chip in contact with an electroplating bath (example 1), a copper electroplating bath, comprising: water as a solvent (paragraph 21); copper ions (paragraph 21); pyrophosphate anions (paragraph 24); Na and K cations added to the electroplating bath as a salt of anions, such that pyrophosphate anions are present in the electroplating bath in stoichiometric excess relative to copper ions (paragraph 24); and 2,5-dimercapto-1,3,4-thiadiazole organic additive (paragraph 28) at a concentration in the range from 0.1 ppm to 1000 ppm (or 0.75 uM to 7500 uM), which is within the range of the instant claim, and electrodepositing copper in said trenches and vias (example 1).

Regarding claim 28, Merricks et al. teach a copper electroplating process comprising a surfactant (paragraph 29).

Regarding claim 30, Merricks et al. teach a copper electroplating process wherein the temperature is maintained between 100F to 135F (or 38C to 57C), which is within the range of the instant claim (paragraph 31).

Regarding claim 31, Merricks et al. teach a copper electroplating process wherein the pH is maintained in the 8.0 to 8.8 range (paragraph 24).

Regarding claim 32, Merricks et al. teach a copper electroplating process comprising ammonium ion (paragraph 25).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Merricks et al. in view of Shipley et al.

Merricks et al. teach the method as described above. Although Merricks et al. teach depositing a copper alloy (paragraph 20), the reference does not explicitly teach the specific alloying element.

Shipley et al. teach "the copper plate deposited from the preferred solution is alloyed with the Group VIII metal cation and is distinguishable from prior art electroless

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copper deposits by substantially improved bending or tensile properties and a smoother, more highly reflecting surface appearance" (abstract).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the bath of Merricks et al. by using the Group VIII metal (such as Fe and Co) as taught by Shipley et al., because it would improve the bending or tensile properties of the plated copper.

Claims 14 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Merricks et al. in view of Jonker et al.

Merricks et al. teach the method as described above. The difference between the reference to Wells et al. and the instant claims is that the reference does not explicitly teach using polyoxyethylene(10)isooctylphenylether as a surfactant.

Jonker et al. teach using polyoxyethylene(10)isooctylphenylether (table 3) as a surfactant for plating copper in order to enhance the ductility of the plated copper (column 4 lines 33-44).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to replace the surfactant of Merricks et al. by using the polyoxyethylene(10)isooctylphenylether surfactant of Jonker et al., because the surfactant would enhance the ductility of the plated copper.

Claims 20 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Merricks et al. in view of Wells et al.

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Merricks et al. teach the method as described above. The difference between the reference to Wells et al. and the instant claims is that the reference does not explicitly teach using nitrate ion.

Wells et al. teach that "the useful range of current density may be further extended by addition of nitric acid, nitrite ions or nitrate ions" (column 2 lines 25-30).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the solution and method of Merricks et al. by using the nitrate ions of Wells et al., because it would extend the useful range of current density for plating copper.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Merricks et al. in view of Wells et al. and Jonker et al.

Merricks et al. teach the method as described above. The difference between the reference to Wells et al. and the instant claims is that the reference does not explicitly teach using nitrate ions nor using polyoxyethylene(10)isooctylphenylether as a surfactant.

Wells et al. teach that "the useful range of current density may be further extended by addition of nitric acid, nitrite ions or nitrate ions" (column 2 lines 25-30).

Jonker et al. teach using polyoxyethylene(10)isooctylphenylether (table 3) as a surfactant for plating copper in order to enhance the ductility of the plated copper (column 4 lines 33-44).



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It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the bath of Merricks et al. by using the nitrate ions of Wells et al., because it would extend the useful range of current density for plating copper, and further replace the surfactant of Merricks et al. by using the polyoxyethylene(10)isooctylphenylether surfactant of Jonker et al. in order to enhance the ductility of the plated copper.

### ***Double Patenting***

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 10-13, 15, 17-20, 24, 26-28 and 30-33 rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-14 of U.S. Patent No. 6,709,564 in view of Merricks et al.

Regarding claims 10 and 24, US patent '564 claims a copper electroplating bath, comprising: water as a solvent (claim 1); copper ions (claim 1); pyrophosphate anions (claim 2); Na and K cations added to the electroplating bath as a salt of anions, such that pyrophosphate anions are present in the electroplating bath in stoichiometric excess relative to copper ions (claim 4); 2,5-dimercapto-1,3,4-thiadiazole organic additive (claim 10). Electrodepositing copper metal in Damascene trenches and vias to form circuitry on semiconductor chips is an intended use of the instant invention and, thus, is not given patentability weight.

Regarding claim 11, US patent '564 claims a copper electroplating bath wherein cations other than copper ions are not electroactive at the potential used for copper electrodeposition, such that relatively pure copper metal is deposited (claim 5).

Regarding claim 15, US patent '564 claims silver (claim 8).

Regarding claim 17, US patent '564 claims a copper electroplating bath wherein the temperature is maintained between 40-60° C, which is within the range of the instant claim (claim 11).

Regarding claim 18, US patent '564 claims a copper electroplating bath wherein the pH is maintained in the 8.0 to 9 range (claim 12).

Regarding claim 19, US patent '564 claims a copper electroplating bath comprising ammonium ion (claim 6).

Regarding claims 26-27, US patent '564 claims a process for electrodepositing copper circuitry in trenches and vias on semiconductor chips, comprising the steps of: providing a semiconductor chip with trenches and vias to be filled with copper (claim 1);

placing said chip in contact with an electroplating bath (claim 1), a copper electroplating bath, comprising: water as a solvent (claim 1); copper ions (claim 1); pyrophosphate anions (claim 2); Na and K cations added to the electroplating bath as a salt of anions, such that pyrophosphate anions are present in the electroplating bath in stoichiometric excess relative to copper ions (claim 6); and 2,5-dimercapto-1,3,4-thiadiazole (claim 10), and electrodepositing copper in said trenches and vias (claim 1).

Regarding claim 30, US patent '564 claims a copper electroplating process wherein the temperature is maintained between 40-60° C, which is within the range of the instant claim (claim 11).

Regarding claim 31, US patent '564 claims a copper electroplating process wherein the pH is maintained in the 8.0 to 9 range (claim 12).

Regarding claim 32, US patent '564 claims a copper electroplating process comprising ammonium ion (claim 6).

Regarding claims 20 and 33, US patent '564 claims a copper electroplating process comprising nitrate ion (claim 14).

US patent '564 differs from the instant claims in that the reference does not explicitly claim the specific concentration of 2,5-dimercapto-1,3,4-thiadiazole (present claims 10, 24 and 26); or a surfactant (claims 13, 24 and 28).

Merricks et al. teach a copper electroplating bath, comprising: 2,5-dimercapto-1,3,4-thiadiazole organic additive (paragraph 28) at a concentration in the range from 0.1 ppm to 1000 ppm (or 0.75  $\mu$ M to 7500  $\mu$ M), which is within the range of the instant claim; and a surfactant (paragraph 29).

Addressing claims 10, 24 and 26, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of US patent '564 by using the 2,5-dimercapto-1,3,4-thiadiazole concentration of Merricks et al., because it would provide bottom-top fill of apertures without voids (paragraphs 9-10 of Merricks et al.)

Addressing claims 13, 24 and 28, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of US patent '564 by using the surfactant of Merricks et al., because it would provide bottom-top fill of apertures without voids (paragraphs 9-10 of Merricks et al.)

Claims 14 and 29 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-14 of U.S. Patent No. 6,709,564 in view of Merricks et al., and further in view of Jonker et al.

US patent '564 claims the method as described above. The difference between the reference to Wells et al. and the instant claims is that the reference does not explicitly claim polyoxyethylene(10)isooctylphenylether as a surfactant.

Jonker et al. teach using polyoxyethylene(10)isooctylphenylether (table 3) as a surfactant for plating copper in order to enhance the ductility of the plated copper (column 4 lines 33-44).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to replace the surfactant of US patent '564 and Merricks et al. by

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using the polyoxyethylene(10)isooctylphenylether surfactant of Jonker et al., because the surfactant would enhance the ductility of the plated copper.

Claim 25 is rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-14 of U.S. Patent No. 6,709,564 in view of Merricks et al. and Jonker et al.

US patent '564 claims the method as described above. US patent '564 differs from the instant claims in that the reference does not explicitly claim the specific concentration of 2,5-dimercapto-1,3,4-thiadiazole or polyoxyethylene(10)isooctylphenylether.

Jonker et al. teach using polyoxyethylene(10)isooctylphenylether (table 3) as a surfactant for plating copper in order to enhance the ductility of the plated copper (column 4 lines 33-44).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the bath of US patent '564 by using the polyoxyethylene(10)isooctylphenylether surfactant of Jonker et al., because it would enhance the ductility of the plated copper. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of US patent '564 by using the 2,5-dimercapto-1,3,4-thiadiazole concentration of Merricks et al., because it would provide bottom-top fill of apertures without voids (paragraphs 9-10 of Merricks et al.)

### ***Response to Arguments***

In the arguments presented on page 8 and 10 of the amendment, the applicant petitions to claim priority to US patent 6,709,564 in order to overcome the Merricks et al. patent. However, the present application is not entitled to the filing date of the parent application, because the limitation of "2,5-dimercapto-1,3,4-thiadiazole at a concentration of less than 4 uM" is not supported by the parent application. The parent application only teaches a concentration of 1-3 ug/L (column 7 lines 54-58), which is not equivalent to the broad limitation of less than 4 uM. According to MPEP 201.11(IB),

Any claim in a continuation-in-part application which is directed *solely* to subject matter adequately disclosed under 35 U.S.C. 112 in the parent nonprovisional application is entitled to the benefit of the filing date of the parent nonprovisional application. However, if a claim in a continuation-in-part application recites a feature which was not disclosed or adequately supported by a proper disclosure under 35 U.S.C. 112 in the parent nonprovisional application, but which was first introduced or adequately supported in the continuation-in-part application, such a claim is entitled only to the filing date of the continuation-in-part application; *In re Chu*, 66 F.3d 292, 36 USPQ2d 1089 (Fed. Cir. 1995); *Transco Products, Inc. v. Performance Contracting Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994); *In re Van Lagenhoven*, 458 F.2d 132, 136, 173 USPQ 426, 429 (CCPA 1972); and *Chromalloy American Corp. v. Alloy Surfaces Co., Inc.*, 339 F. Supp. 859, 874, 173 USPQ 295, 306 (D. Del. 1972).

Therefore, the rejections using Merricks et al. under 35 USC 102 is proper.

### ***Conclusion***

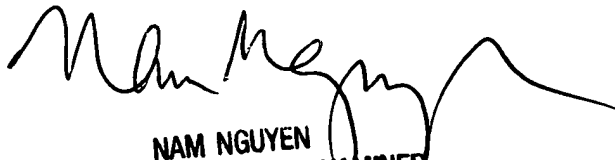
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luan V. Van whose telephone number is 571-272-8521. The examiner can normally be reached on M-F 9:30-6:00.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LWV  
June 20, 2006



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SUPERVISORY PATENT EXAMINER  
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